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Editorial: Towards energy efficient and sustainable transportation networks

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This special issue of the European Journal of Transport and Infrastructure Research comprises six papers, with a focus on energy efficiency and sustainability in transportation networks. Preliminary versions of those papers were presented during the EWGT 2012 Conference, the 15th meeting of the Euro Working Group on Transportation. The contributions have been selected to reflect the diversity of topics and approaches presented during the conference. They have been substantially extended by their respective authors and carefully reviewed and revised; this special issue contains the final selection of accepted papers. The editors are grateful to the authors and referees for their prompt and careful collaboration during the preparation of this special issue. This editorial first provides a few additional words about the Euro Working Group on Transportation and about the EWGT 2012 Conference, and then presents the selected contributions.

1. The Euro Working Group on Transportation

The Euro Working Group on Transportation was set up at the end of 1991, during the closing ceremony of a summer school in Cetraro, Italy. The original goals were to share, compare and develop operations research in the fields of transportation and traffic management. Operations research finds its roots in decision-aiding. In turn, decision-aiding and policy-making in transportation and infrastructure management can find fruitful inspiration from operations research. Over the years, the EWGT meeting has become a conference of international stature, attracting researchers from all over the world, albeit with a majority of Europeans. The spectrum of topics addressed during EWGT meetings has broadened. This is the result of contributions not only from researchers in the field of operations research, but also from colleagues working in economics, sociology, geography, spatial planning, and many others fields in connection with transportation.

2. The EWGT 2012 conference

The EWGT 2012 was a very successful event, held in Cité Descartes, Paris, in September 2012, with an unprecedented number of contributions in the history of EWGT meetings. It was focused

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on energy efficiency and sustainability in transportation networks. From the 280 contributions received, 170 were selected for presentation, and 134 published in the proceedings of the conference.[3]

Energy efficiency and sustainability of transportation networks were the two prominent topics in the EWGT 2012 call for papers. The scope was broad, and many valuable contributions have been received. Selecting a few among them for review and possible publication in EJTIR was not an easy duty. Indeed, making transportation networks more sustainable and energy efficient is one of the key issues policy makers will face in the coming decades. By its very nature the challenge involves multiple disciplines and fields. Electric vehicles, eco-driving, teleworking are a few examples of levers for action policy makers may act upon. This special issue tries to reflect the variety and diversity of domains and approaches presented during the EWGT 2012 conference.

3. Selected contributions

As previously stated, it is the editors' intent that the selected papers reflect many aspects of energy management and sustainability in transportation networks addressed during the EWGT 2012 conference. The following four topics are addressed in the sequel:

- fuel consumption reduction;
- electric vehicles;
- teleworking;
- network analysis.

3.1 Fuel consumption reduction

Many technologies and various approaches can help in reducing vehicles' fuel consumption. One is eco-driving. The opening paper, by Andrieu and Saint-Pierre, compares eco-driving teaching methods, a key to understand the cost-effectiveness of an implementation strategy. Indeed, eco-driving is known to cut down fuel consumption by up to 20%. But little is known about differences induced by different eco-driving teaching methods. Two kinds of experiments are analysed in this paper. In the first one, simple advice were given to the participants, while in the second one, full courses with eco-driving experts were used. Results show that ecodriving advices are better applied after a course than just providing tips. The approach is then extended to build a generic model that can be used both to characterize and evaluate eco-driving style.

Another way to reduce fuel consumption is to have a better longitudinal control of the vehicle. The paper by Fu and Bortolin presents an optimal control algorithm for optimizing off-road construction vehicles gear shift sequences. Although focused on off-road vehicles, the algorithm should obviously apply to any kind of heavy duty vehicles, including trucks. The paper explores the possibility of using recorded road slope data in order to reduce fuel consumption for off-road construction vehicles such as articulated haulers. Road gradients have strong influence on the fuel consumption of a vehicle. This effect is even more significant on construction vehicles due to their large mass and heavy load. In this study, a control algorithm based on model predictive control and dynamic programming is formulated and solved to find an optimal gear shift sequence and time of shifting. The fuel consumption model of an articulated hauler is formulated with a dynamic model and used together with the travel time in the objective function to balance the trade-off between these two aspects. The proposed control algorithm is simulated on a typical road stretch on the construction work site with frequent steep up- and downhill. Simulation shows that both fuel consumption and travel time can be reduced simultaneously. In addition, the optimal gear shift sequence resembles the behaviour of an experienced driver.

[3] Available online: http://www.sciencedirect.com/science/journal/18770428/54

3.2 Electric vehicles

Electric vehicles are appearing on the market. The paper by Rolim et al. presents a study of early electric vehicle (EV) adopters in the city of Lisbon, including utilization patterns and environmental impacts. This project assesses electric vehicle users' motivations, daily patterns and vehicle operation and management. Promoted by EMEL – Lisbon's mobility and parking municipal company – the project was publicized among Lisbon's electric vehicle users, who were offered, as an incentive, a green permit which allowed them to park the vehicles for free on the street within the city's metropolitan central area.

The results indicate that environmental and economic factors are the main drivers for electric vehicle adoption by private users, whereas fleet drivers mention their company's image as the motive behind the deployment of this technology in fleets. Private users' energy consumption and CO_2 emissions were also estimated. When compared to conventional internal combustion engine vehicles running on gasoline or diesel, electric vehicles reveal considerable reductions in both energy consumption and CO_2 emissions in a well-to-wheel life cycle approach. These decreases are between 35–43% for energy consumption and 58–63% for CO_2 emissions.

3.3 Teleworking

Pushing the limits of reasoning, one could state that a way to improve the energy efficiency of transportation networks is … to avoid transportation. More seriously, teleworking can help reducing the demand for transportation. Van Lier et al. investigates how worthwhile teleworking is from a sustainable mobility perspective in the Brussels Capital region. Teleworking is often suggested as an instrument to reduce the environmental and socio-economic impacts of mobility on society. Currently, the implementation of teleworking is however still rather limited and fragmental in most companies in Belgium. Goal of this paper is to assess whether further encouragement of telework is advisable from a sustainable mobility viewpoint.

Based on Belgian survey data, an appraisal of the environmental and mobility related impacts of telework for companies located in the Brussels Capital Region is performed, using an analysis of the strengths, weaknesses, opportunities and threats of telework. In order to quantify the effects, external costs of trips to the central headquarter office are compared to those of trips to decentralized satellite offices and those caused by additional distances travelled when teleworking at home. Modal shifts occurring between trips travelled to the central office and trips travelled to the satellite office are taken into account and play an important role in the overall impact on external transport costs. Also receptor density and congestion levels along the routes travelled are taken into account.

3.4 Network analysis

Infrastructure planners and operators target sustainable design and operation of transportation networks. On the operations side, cost-benefit analysis of traffic management strategies are now required to deal with environmental externalities. Typically, within-day dynamic estimations of pollutant emissions in congested urban networks are a prerequisite for a better assessment of related transportation policy measures. Gori et al. proposes a new methodological framework to this end. The paper presents a new methodological framework to address the problem of estimating pollutant emissions for large congested urban networks in a within-day dynamic context. The framework comprises three main modules. The first computes pollutant emissions for general links. The second module computes pollutant emissions for all links approaching a signalized intersection. The third module computes pollutant emissions for all links approaching an unsignalized intersection. A dynamic mesoscopic assignment model is performed to derive the main dynamic input of each one of the modules. All the modules have been tested in a real case study within the city of Rome, Italy.

Finally, while targeting sustainable design, lessons might be learned from the study of transportation networks resilience to catastrophic events. The last paper, by Da Costa et al.,

analyses the response operations to natural disasters, in the light of the logistics processes adopted in response to six recent major natural disasters: the Mozambique flooding in 2000; the Pakistan earthquake in 2005; the Indian Ocean tsunami in 2006; the earthquake in Haiti in 2010; the flood and landslide in the mountainous region of Rio de Janeiro, Brazil in 2010; and the earthquake and tsunami in Japan in 2011. Through the analysis of secondary data, the main practices, problems and challenges in these post-disaster humanitarian operations are identified. This study aims to understand the environment and circumstances in which these humanitarian operations occurred, assessing the main constraints encountered and the approaches adopted to ensure the supply of relief to victims of natural disasters. Finally, suggestions are proposed in order to improve the efficiency and success rate of the logistics process in other humanitarian response operations.